Abstract Submitted
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Determining the optimal smoothing length scale for actuator line models of wind turbine blades[1] LUIS MARTINEZ, CHARLES MENEVEAU, Johns Hopkins University — The actuator line model (ALM) is a widely used tool for simulating wind turbines when performing Large-Eddy Simulations. The ALM uses a smearing kernel $\eta_\epsilon = 1/\epsilon^3\pi^{3/2}\exp\left(-r^2/\epsilon^2\right)$, where r is the distance to an actuator point, and ϵ is the smoothing length scale which establishes the kernel width, to project the lift and drag forces onto the grid. In this work, we develop formulations to establish the optimum value of the smoothing length scale ϵ, based on physical arguments, instead of purely numerical constraints. This parameter has a very important role in the ALM, to provide a length scale, which may, for example, be related to the chord of the airfoil being studied. In the proposed approach, we compare features (such as vertical pressure gradient) of a potential flow solution for flow over a lifting surface with features of the solution of the Euler equations with a body force term. The potential flow solution over a lifting surface is used as a general representation of an airfoil. The method presented aims to minimize the difference between these features of the flow fields as a function of the smearing length scale (ϵ), in order to obtain the optimum value.

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